REMARKS

This response responds to the Office Action dated January 30, 2004 in which the Examiner rejected claims 1-20 under 35 U.S.C. §103.

Claim 1, 4, 10 and 13 claim a digital camera that records a captured image as digital data. The digital camera comprises an image pickup device, an A/D converter, a recording device, a data processor and a display device. The data processor interpolates for missing pixels for each color or component using a first process. An external device interpolates for missing pixels for each color or component using a second process which is different from the first process.

Through the structure of the claimed invention having a data processor which interpolates for missing pixels for each color using a first process and having an external device interpolate for missing pixels for each color using a different process, as claimed in claims 1, 4, 10 and 13, the claimed invention provides a digital camera in which the image can be immediately displayed on a display unit so that the user can preview the image. The prior art does not show, teach or suggest the invention as claimed in claims 1, 4, 10, and 13.

Claims 6 and 14 claim a method for recording and displaying an image comprising the steps of; the first, sensing an image with an image sensor having an array of pixels. Each pixel generates data relating to one of a plurality of colors or components. Next, both data generated by the individual pixels of the image sensor and information which describes the colors or components that are associated with the individual pixels are simultaneously stored at a first site. The stored data and stored information from the first site are then transmitted to a second site. The data at the second site is interpolated in accordance with the stored information to

generate complete color or image data for the individual pixels. Finally, the image is reproduced in accordance with the complete color or image data.

Through the method of the claimed invention simultaneously storing data which is generated by the individual pixels and information which describes the arrangement of the individual pixels relative to different components or colors as claimed in claims 6 and 14, the claimed invention provides a method for recording and displaying an image which reduces the load on the recording medium data storage capacity. The prior art does not show, teach or suggest the method as claimed in claims 6 and 14.

Claims 1-5, 10-13, 17 and 19 were rejected under 35 U.S.C. §103 as being unpatentable over *Nohda* (U.S. Patent No. 6,295,087) in view of *Konishi* (U.S. Patent No. 4,574,319).

Applicant respectfully traverses the Examiner's rejection of the claims under 35 U.S.C. §103. The claims have been reviewed in light of the Office Action, and for reasons which will be set forth below, applicant respectfully requests that the Examiner withdraws the rejection to the claims and allows the claims to issue.

Nohda appears to disclose a signal processing apparatus for increasing a resolution of a pickup image data by way of interpolation. (col. 1, lines 6-8) An image pickup apparatus according to a first embodiment is a single-plate type, enabling to obtain a high resolution, for example, by synthesizing a high frequency luminance component generated by an interpolation between pixels for respective signals obtained from a single CCD (charge coupled device) image sensor. (col. 3, lines 30-35) An adaptive interpolation circuit 19 calculates a local pixel correlation from the color signals R and G and executes interpolation with a pixel which

maximizes the correlation so as to obtain a luminance signal of a high resolution. (col. 4, lines 5-9, emphasis added) If the correlation is calculated for each of the vertical, horizontal, and inclined directions, and interpolation is executed in a direction which maximizes the correlation, the signal will not be subjected to the LPF in a direction which orthogonally intersects the interpolation direction and accordingly, the resolution in the orthogonal direction will not be deteriorated. In other words, the resolution can be improved by executing interpolation according to the correlation. (col. 4, lines 28-36) As has been described above, in the image pickup apparatus 10 according to the present embodiment, by executing the adaptive interpolation of the R and G pixels from the color filter arrangement, it is possible to improve a resolution not only in the vertical and the horizontal direction but also in the diagonal directions. (col. 7, lines 34-39) FIG. 12 is a block diagram of an image pickup apparatus 30 according to the second embodiment consisting of an image pickup block 30A and a computer block 30B. Color signals R, B, and B obtained in the image pickup block 30A are subjected to the adaptive interpolation by a software of the computer block 30B. (col. 7, lines 57-62) The image pickup block 30A is provided with a simplified interpolation circuit 31 for executing a simplified interpolation to the respective signals from the DSP 15 and a personal computer interface (hereinafter, referred to as PC interface) 32 for executing a predetermined signal conversion for transmitting the color signals from the DSP 15, to the computer block 30B so that interpolated color signals are outputted. The image pickup block 30A is arranged so as to transmit the respective color signals via a bi-directional bus 33 to the computer block 30B and receive a control signal from the computer block 30B. On the other hand, the computer block 30B includes: a personal computer

(PC) interface 34 which is preferable for use in a personal computer and in which respective color signals are transmitted via a bi-directional bus 33; a hard disk drive (HDD) memory 35 for storing a program and the like; an LPF 17 for cutting off a higher frequency component from the respective color signals from the PC interface 34; a buffer memory 18 for storing the respective color signals from the LPF 17; an adaptive interpolation circuit 19 for executing the adaptive interpolation to the respective color signals from the PC interface 34; a HPF 20 for cutting off a lower frequency component from the respective color signals from the adaptive interpolation circuit 19; a buffer memory 21 for storing a luminance signal YH from the HPF 20; an adder circuit 22 for adding the signals from the buffer memory 18 and the buffer memory 21; and an accelerator 36 for outputting to a monitor 50 the respective color signals from the adder circuit 22. In the image pickup apparatus 30 having the aforementioned configuration, the CCD image sensor 11 generates color signals R, G, and B for supply to the DSP 15 via the CDS/AGC circuit 13 and the A/D convert 14. An output from the DSP 15 is converted into a video signal by the video encoder 23 and is outputted as a VBS (video, burst, sync) signal or luminance/color difference signal Y/C. Moreover, the output of the DSP 15 is subjected to a simplified interpolation in the simplified interpolation circuit 31 and outputted as a color signal or transmitted via the PC interface 32 to the computer block 30B. In the computer block 30B, the PC interface 34 supplies the respective color signals to the adaptive interpolation circuit 19 and to the LPF 17. The LPF 17 removes a higher frequency component from the respective color signals and supplies the color signals via the buffer memory 18 to the adder circuit 22. The adaptive interpolation circuit 19 executes an adaptive interpolation by carrying out

the aforementioned steps S1 to S22 and steps S31 to S34, and supplies the HPF 20 with a luminance signal Y and respective color signals R, G, and B shown in FIG. 10. (col. 8, lines 5-58)

Thus, *Nohda* merely discloses executing interpolation based upon color signals R and G (column 4, lines 5-9, column 7, lines 34-39, column 8, lines 54-58). Nothing in *Nohda* shows, teaches or suggests a) a data processor which interpolates for each color and b) an external device which interpolates for each color as claimed in claims 1, 4, 10 and 13. Rather, *Nohda* merely discloses an adaptive interpolation circuit which executes interpolation based upon color signals R and G.

Additionally, *Nohda* merely discloses generating a high frequency luminescence component by an interpolation between signals R and G. Nothing in *Nohda* shows, teaches or suggests a data processor and an external device which interpolates for missing pixels as claimed in claims 1, 4, 10 and 13. Rather, *Nohda* merely discloses that the interpolation is for generating a high frequency luminescence component.

Konishi appears to disclose when the image is formed on the image pickup device 5, each photoelectric conversion picture element constituting the image pickup device 5 generates an electric signal according to the light intensity received thereat, and temporarily stores the electric signal. The electric signal stored in the photoelectric conversion cells is then sequentially output from a scanner 6 to a signal processor 7. The signal processor 7 has an amplifier, a quantizer or the like, and performs processing operations such as amplification, encoding or the like of the electric signal fed from the scanner 6. The electric signal thus processed is then recorded on a recording medium 10, which is releasably fitted on a recorder 9, as the

image data is recorded by the recorder 9 according to a synchronizing signal generated by a synchronizing signal generator 8. (col. 3, lines 50-65) The addresses of defective picture elements of the image pickup device 5, information on the arrangement of the color filter array provided on the surface of the image pickup device 5, or the like, are already fixed when the image pickup device 5 is manufactured. Data of this type may for example be output as the data for compensation in image reproduction when the data is recorded on the recording medium by use of a ROM (read only memory) for encoding and storing these data in the data memory 13. The above-mentioned code for discriminating between continuous shooting and single frame shooting modes of the photographed image may be recorded by using the members for indicating these modes in the camera body, or may be automatically recorded by detecting the shutter operation. The camera body 2 is also provided with a shutter button 16, view finder 17 or the like as in the case of a conventional camera. The above-described various data to be recorded together with the image data are input to the recording medium as described below. For example, information on defective addresses for indicating the positions of defective picture elements of the image pickup device 5, information on the arrangement of the color filter array provided on the surface of the image pickup device 5, information which is already fixed when the image pickup device 5 is manufactured and which effects all image information recorded, the code for keeping the whole record secret, or the like, are automatically recorded by the ROM for encoding and storing these types of information in the data memory 13 when the loading of the recording medium 10 into the camera body 2 is detected. Or, such information is manually input to the recording medium 10 by use of the manual data

input unit 14 after recording medium 10 loaded into the camera body 2. (col. 4, line 56 through col. 5, line 23)

Thus, *Konishi* merely discloses a camera including a signal processor which performs processing operations on the electrical signal fed from a scanner 6. Nothing in *Konishi* shows, teaches or suggests a data processor which interpolates for missing pixels for each color using a first process and an external device that interpolates for missing pixels for each color using a different process as claimed in claims 1, 4, 10 and 13. Rather, *Konishi* merely discloses a signal processor which performs processing operations.

The combination of *Nohda* and *Konishi* would merely suggest to increase the resolution of pickup image data by way of interpolation as taught by *Nohda* or using a camera having a signal processor which performs processing operations on an electrical signal fed from a scanner 6 as taught by *Konishi*. Thus, nothing in the combination of *Nohda* and *Konishi* show, teach or suggest a) a data processor which interpolates for missing pixels for each color and b) an external device which interpolates for missing pixels for each color as claimed in claims 1, 4, 10 and 13. Therefore, Applicant respectfully requests the Examiner withdraws the rejection to claims 1, 4, 10 and 13 under 35 U.S.C. §103.

Claims 2-3, 5, 11-12, 17 and 19 recite additional features. Applicant respectfully submits that claims 2-3, 5, 11-12, 17 and 19 would not have been obvious within the meaning of 35 U.S.C. §103 over *Nohda* and *Konishi* at least for the reasons as set forth above. Therefore, Applicant respectfully requests the Examiner withdraws the rejection to claims 2-3, 5, 11-12, 17 and 19 under 35 U.S.C. §103.

Claims 6, 8, 9, 14, 16, 18 and 20 were rejected under 35 U.S.C. §103 as being unpatentable over *Nohda* in view of *Konishi* and further in view of *Parulski et al.* (U.S. Patent No. 5,040,068).

Applicant respectfully traverses the Examiner's rejection of the claims under 35 U.S.C. §103. The claims have been reviewed in light of the Office Action, and for reasons which will be set forth below, applicant respectfully requests that the Examiner withdraws the rejection to the claims and allows the claims to issue.

As discussed above, *Nohda* merely discloses a) increasing resolution of a pickup image data using interpolation and b) executing adaptive interpolation of the R and G pixels. Nothing in *Nohda* shows, teaches or suggests simultaneously storing a) data which is generated by individual pixels and b) information which describes the colors that are respectively associated with the individual pixels or which describes the arrangement of the individual pixels relative to different components as claimed in claims 6 and 14. Rather, *Nohda* merely discloses increasing resolution of a pickup image by a high frequency luminescence component generated by interpolation between R and G pixels.

As discussed above, *Konishi* merely discloses automatically recording different types of information in a data memory when the recording medium 10 is loaded into the camera body 2 (column 5, lines 6-23). Nothing in *Konishi* shows, teaches or suggests simultaneously storing data generated by individual pixels of an image sensor and information which describes colors associated with the individual pixels or which describes the arrangement of the individual pixels relative to different components as claimed in claims 6 and 14. Rather, *Konishi* discloses that

information is stored about the arrangement of the color filter array when the recording medium 10 is loaded into the camera body 2.

Parulski et al. appears to disclose an electronic imaging apparatus separable into a plurality of modular components. (col. 1, lines 7-9) Referring initially to FIG. 1, electronic imaging apparatus is divided generally into an image recording unit 2 and a pair of interchangeable image pickup units 4a and 4b, one each for the acquisition of monochrome and color images. (col. 3, lines 19-22) The analog image signals are applied to the terminal 10a located in the terminal block 10. The horizontal and vertical clocks needed for driving the image sensor 6 are input through the terminal 10b and over (one or more) line(s) 12 to the image sensor 6. Coding means 14 provides an identifying signal to the terminal 10c for identifying the image pickup unit 4a according to the characteristics of the image sensor 6 included therewith; that is, the identifying signal signifies that the image pickup unit 4a provides a monochrome signal. (col. 3, lines 31-61) The image pickup unit 4a is replaced with the image pickup unit 4b when acquisition of a color image is desired. Besides the image sensor 6, the coding means 14, and the terminal block 10, the image pickup unit 4b additionally includes a color filter array 20 positioned over the photosensitive surface of the image sensor 6 in the path of image light. The sensor 6, when clocked from the terminal 10b, consequently provides a sequence of color-dependent signals to the terminal 10a corresponding to the particular color pattern of the array 20. Accordingly, the identifying signal provided by the coding means 14 signifies that the image pickup unit 4b provides a color image signal. In addition, the identifying signal may specify the type of color filter array pattern (e.g., the "three green" pattern), as this information is useful in the subsequent signal processing to separate

the respective colors. (col. 4, lines 1-19) When the pickup unit 4a (or 4b) is attached to the recording unit 2, the respective circuits are completed between pickup terminals 10a, 10b, 10c and recording terminals 32a, 32b, 32c, which forms an interface for transferring signals between the pickup unit 4a (or 4b) and the recording unit 2. The analog image signals present on the terminal 32a are applied to an A/D converter 34, which generates a digital image signal from the analog input signal for each picture element. The digital signals are applied to an image buffer 36, which is a random access memory (RAM) with storage capacity for all, or a part of, a still picture. The horizontal and vertical clocks needed for driving the sensor 6 are generated by a timing generator 38 and applied to the terminal 32b. The identifying signal present on the terminal 32c is applied to a control processor 40. (col. 4, lines 33-49) The control processor 40 decodes the identifying signal and generally controls the recording unit 2 and the image pickup unit 4a (or 4b) by initiating and controlling exposure (by instructing the control element 42 to operate the diaphragm 26 and the shutter 28), by controlling operation of the timing generator 38, and by enabling the A/D converter 34 in conjunction with the image buffer 36 for each signal segment relating to a picture element. (col. 4, lines 53-61) In particular, the identity of the pickup unit (monochrome or color) is obtained from the identifying signal and output to the display section 48 for display as a corresponding message. The control processor 40 also calculates proper exposure conditions (shutter, aperture) based on the ambient light 52a sensed by a light measuring circuit 52 and the photographic speed of the image sensor 6 (as provided by or inferred from the identifying signal from the coding means 14). The control processor 40 further directs the digitized image signals to a detachable memory module 54 via a connector 56. The memory

module 54 may be tethered to the image recording unit 2 via a cable (not shown) or it may be fitted to mate with the connector 56 on the recording unit 2. (col. 4, line 68 through Col. 5, line 14)

Thus, *Parulski et al.* merely discloses a) a coding means 14 which provides an identifying signal to identify whether an image pickup unit 4a or image pickup unit 4b is attached to an image recording unit 2 and b) a control processor 40 which decodes the identifying signal to control the image pickup unit 4a or 4b. Thus nothing in *Parulski et al.* shows, teaches or suggests simultaneously storing data generated by individual pixels and information which describes the colors associated with the individual pixels or which describes the arrangement of the individual pixels relative to different components as claimed in claims 6 and 14. Rather, *Parulski et al.* merely discloses a controller which uses an identifying signal in order to control sensors 4a, 4b.

The combination of *Nohda*, *Konishi* and *Parulski et al.* would merely suggest synthesizing a high frequency luminescence component generated by interpolation between R and G pixels as taught by *Nohda*, automatically recording filter information when a recording medium is loaded into a camera body as taught by *Konishi* and controlling the pickup device of *Nohda* based upon an identifying signal as taught by *Parulski et al.* Thus, nothing in the combination of *Nohda*, *Konishi* and *Parulski et al.* shows, teaches or suggests simultaneously storing data, which is generated by individual pixels, and information, which describes colors associated with the individual pixels or which describes the arrangement of the individual pixels relative to different components, as claimed in claims 6 and 14. Therefore, Applicant

respectfully requests the Examiner withdraws the rejection to claims 6 and 14 under 35 U.S.C. §103.

Claims 8, 9, 16, 18 and 20 recite additional features. Applicant respectfully submits that claims 8, 9, 16, 18 and 20 would not have been obvious within the meaning of 35 U.S.C. §103 over *Nohda*, *Konishi* and *Parulski et al.* at least for the reasons as set forth above. Therefore, Applicant respectfully requests the Examiner withdraws the rejection to claims 8, 9, 16, 18 and 20 under 35 U.S.C. §103.

Claims 7 and 15 were rejected under 35 U.S.C. 103 as being unpatentable over *Nohda* in view of *Konishi* and further in view of *Parulski et al.* and *Rashkovskiy et al.* (U.S. Patent No. 6,181,376).

Applicant respectfully traverses the Examiner's rejection of the claims under 35 U.S.C. §103. The claims have been review in light of the Office Action, and for reasons which will set forth below, Applicant respectfully requests the Examiner withdraws the rejection to the claims and allows the claims to issue.

As discussed above, since nothing in the combination of the primary references shows, teaches or suggests the primary features as claimed in claims 6 and 14, Applicant respectfully submits that the combination of the primary references with the secondary reference to *Rashkovskiy et al.* will not overcome the deficiencies of the primary references. Therefore, Applicant respectfully requests the Examiner withdraws the rejection to claims 7 and 15 under 35 U.S.C. §103.

Thus it now appears that the application is in condition for reconsideration and allowance. Reconsideration and allowance at an early date are respectfully requested.

If for any reason the Examiner feels that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the applicant's undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed within the currently set shortened statutory period, applicant respectfully petitions for an appropriate extension of time. The fees for such extension of time may be charged to our Deposit Account No. 02-4800.

In the event that any additional fees are due with this paper, please charge our Deposit Account No. 02-4800.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

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By: _____

Ellen Marcie Emas
Registration No. 32,131

P.O. Box 1404
Alexandria, Virginia 22313-1404
(703) 836-6620